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A NOVEL METHOD OF ASCOSPORE DISCHARGE

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It has been generally observed that ascospores are discharged commonly from the apex of the ascus which ruptures at this point just before the ascospores are liberated. A few forms, such as *Claviceps*, have also been reported where the ascospores are discharged through the lower end of the ascus when it is torn from the perithecial base. A still different method of ascospore discharge, however, has recently been observed in certain *Pyrenophora* species. These have developed on the leaves and stems of *Bromus* and *Agyropyron repens* which earlier showed *Helminthosporium* lesions and are regarded as the perfect stages of these *Helminthosporium* species. *Pleospora herbarum* (Pers.) Rab., studied on various hosts has shown the same phenomenon. In these cases, the ascospore discharge is preceded by a modification of the ascus and the spores are then liberated from the side of the ascus.

Upon placing a mature perithecium having fully developed asci and ascospores in a drop of water on a microscope slide, the asci are readily liberated by slight pressure upon the perithecium wall and the ascospore discharge can be studied under the low power lens. The ascus wall in these species consists of two layers, the outer of which is thinner but more firm; the inner, much thicker and less firm. These two walls are not distinguishable, however, until the moment of ascospore discharge. When the ascus is liberated from the perithecium it begins to imbibe water. This seems to take place so rapidly that in a few seconds the ascus swells to one and one half times its original size. The pressure on the outer wall soon becomes so great that the latter ruptures at the apex of the ascus, contracts, and slips down toward the base with great rapidity. In some cases, however, all of this occurs less rapidly and can be easily followed under the micro-

scope. The ruptured outer wall contracts both in length and width. Soon the outer wall contracts at a point about one third of the distance up from the base of the ascus, thus forming a ring, while the ascus continues to swell by taking in more water. The pressure, partly released after the rupture of the outer wall,

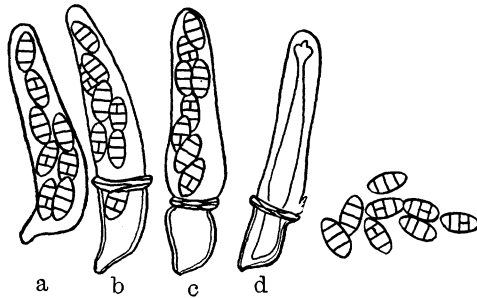


Fig. 1. Camera lucida drawing of an ascus of *Pyrenophora* in different stages of ascospore discharge, showing: *a*, normal ascus immediately after leaving the perithecium; *b*, outer wall ruptured and contracted in form of ring; *c*, ascus with all ascospores above the ring, pressure in ascus nearing critical point; *d*, discharged ascus with ascospores lying as thrown from ascus.

continues to increase until it reaches the critical point once more; the inner wall then ruptures, not at the apex, but just above the ring formed by the contracted outer wall, and the spores are thrown out with great force. Because of the resistance of the

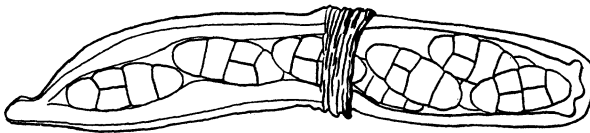


Fig. 2. Camera lucida drawing of ascus under high power, showing the two ascus walls, the outer ruptured and partially contracted, the inner much thickened and pressing upon the ascospores especially in the lower part.

water, they usually remain near the point of rupture of the inner wall, but that they are thrown out with great force is shown by the rapidity of their motion which is so great that it is very difficult to follow their exit from the ascus. The rapid shrinking of the empty ascus after the discharge of spores corroborates this point.

The ascospores before and during the swelling of the ascus are distributed uniformly throughout the ascus. After the formation of the ring, however, partly because of the rupturing and contraction of the outer wall, but more particularly because of the thickening of the inner wall, especially in the lower part of the ascus, there seems to be an upward movement of the ascus contents and usually before the breaking of the inner wall all ascospores are above the ring. Occasionally it was observed that single spores remained below the ring, but such spores usually remain inside the ascus even after the breaking of the inner wall.

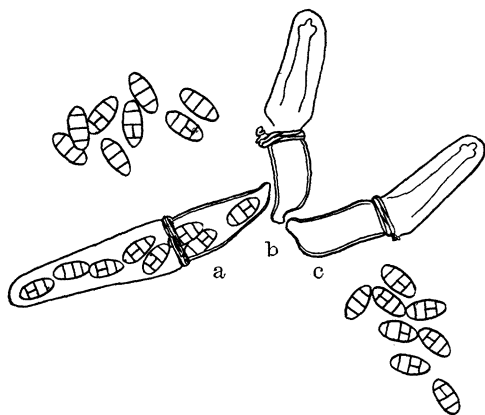


Fig. 3. Camera lucida drawing of group of asci, showing: *a*, swollen ascus with contracting outer wall; *b* and *c*, ruptured asci with ascospores lying as discharged.

Only in very rare cases, mostly in improperly developed asci, are there any spores left in the upper part of the ascus after the breaking of the inner wall.

The time that elapses from the moment of the liberation of the ascus from the perithecium to the time of its swelling and the rupturing of the outer wall varies considerably. It may take only a few seconds (15–30) or even several minutes or longer. The length of the time that elapses from the rupturing of the outer wall to the rupturing of the inner wall varies also. In some cases it is less than 30 seconds; in others it may be as long as 30 minutes.

Pfeffer in his "Physiology of Plants," 2d edition, v. 3, pp. 149-150, fig. 34, has described a case of ascospore discharge which resembles the above only in the behavior of the outer wall. Here the inner wall, instead of breaking above the ring formed by the outer wall, breaks at the top, and the spores are discharged not all at once but one by one. First one spore takes its place immediately at the apex, the inner wall breaks at that point, and the spore is thrown out. The next spore closes the opening of the inner wall and remains there until the pressure inside of the ascus becomes great enough to cause ejection. After this spore is thrown out, the next one takes its place and so on.

The method of ascospore discharge described here for some *Pyrenophora* and *Pleospora* species is the only method of ascospore discharge observed by the writer for these fungi. The material studied was gathered at different times throughout the spring and summer of 1918, and also during the early part of February, 1919, from different localities around Madison, Wis.

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